Research for Evidence-Informed Decision-Making

Research Strategy for Rational Pharmacotherapy 2018–2022

REPORTS AND MEMORANDUMS OF THE MINISTRY OF SOCIAL AFFAIRS AND HEALTH 25/2018

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Research for Evidence-Informed Decision-Making: Research Strategy for Rational Pharmacotherapy 2018–2022

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Abstract

This research strategy has been developed as part of the Implementation Programme for Rational Pharmacotherapy (Ministry of Social Affairs and Health 2018) in accordance with Prime Minister Juha Sipilä's Government Programme. The objective is to promote evidence-informed decision-making in the implementation of rational pharmacotherapy. According to the objective, by 2022:

- research on and development of rational pharmacotherapy are a part of the social and health services system,
- research is utilised diversely in informing decision-making in the social and health services system and in medicines policy, and
- research and allocation of resources to the research areas presented in the research strategy are strong.

The research strategy applies Donabedian's (1997) theory on quality of care, which divides factors influencing quality of care into three areas: structure, process and outcomes. Accordingly, the research areas in this Strategy have been divided into the following three areas:

- research on structures and operational preconditions promoting rational pharmacotherapy,
- research on the medication processes in diverse settings to promote pharmacotherapy and medication safety, and
- research on medicines use and effectiveness and economy of pharmacotherapy.

The research strategy describes the current state of research and proposes several ways for improving the preconditions for research. It is important to increase multidisciplinary networking and research collaboration, create preconditions for long-term research and new research openings, intensify the use of research resources and improve research infrastructure, and allocate research funding to research that promotes rational pharmacotherapy.

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Tiivistelmä

Tutkimusstrategia on laadittu osana pääministeri Juha Sipilän hallitusohjelman mukaista rationaalisen lääkehoidon toimeenpano-ohjelmaa (Sosiaali- ja terveysministeriö 2018). Tavoitteena on edistää tutkimustiedon hyötykäyttöä rationaalisen lääkehoidon toimeenpanossa. Tavoitteen mukaisesti vuoteen 2022 mennessä:

- rationaalisen lääkehoidon tutkimus ja kehittäminen ovat osa sote-järjestelmää,
- tutkimustietoa hyödynnetään monipuolisesti sote-järjestelmän toiminnan ohjauksessa ja lääkepoliittisessa päätöksenteossa ja
- tutkimusstrategiassa esitettyjen tutkimusalueiden tutkimus ja resursointi on vahvaa.

Tutkimusstrategiassa on hyödynnetty Donabedianin (1997) hoidon laatuun vaikuttavien tekijöiden määrittelyä kolmeen osa-alueeseen: rakenne, prosessi ja tulokset. Tämän mukaisesti tutkimusalueet on jaoteltu seuraavasti:

- rationaalista lääkehoitoa edistävien rakenteiden ja toimintaedellytysten tutkimus,
- lääkitysturvallisuutta eri toimintaympäristöissä edistävä lääkehoidon toteutusprosessien tutkimus, sekä
- lääkkeiden käytön ja lääkehoidon vaikuttavuuden sekä taloudellisuuden tutkimus.

Tutkimusstrategiassa kuvataan tutkimuksen nykytilaa ja esitetään useita keinoja tutkimusedellytysten parantamiseksi. Tärkeää on lisätä monitieteistä verkostoitumista ja tutkimusyhteistyötä, luoda edellytyksiä pitkäjännitteiselle tutkimukselle ja uusille tutkimusavauksille, tehostaa tutkimusresurssien käyttöä ja parantaa tutkimusinfrastruktuuria sekä suunnata tutkimusrahoitusta rationaalista lääkehoitoa edistävään tutkimukseen.

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Forskningsstrategin har utarbetats som en del av genomförandeprogrammet förrationell läkemedelsbehandling i enlighet med Sipiläs regeringsprogram. Målet är att utnyttja forskningsrön vid genomförandet av rationell läkemedelsbehandling. Senast 2022 ska

- forskning och utveckling inom rationell läkemedelsbehandling vara en del av socialoch hälsovårdssystemet
- forskningsrön utnyttjas i styrningen av socialoch hälsovårdssystemet och det politiska beslutsfattandet och
- forskningen inom och fördelningen av resurser till forskningsområden i forskningsstrategin vara stark.

I forskningsstrategin har man utnyttjat Donabedians definition av faktorer som påverkar vårdkvaliteten i tre delområden: struktur, process och resultat. I enlighet med denna har forskningsområdena delats in enligt följande:

- forskning om strukturer och verksamhetsförutsättningar som främjar rationell läkemedelsbehandling
- forskning om genomförandeprocesser för läkemedelsbehandling som främjar säkerhetenvid medicinering
- forskning om läkemedelsanvändning och läkemedelsbehandlingars effekter i klinisk praktik samt lönsamhet.

I forskningsstrategin beskrivs nuläget för forskningen och presenteras flera metoderför att förbättra förutsättningarna för forskningen. Det är viktigt att öka mångvetenskapligt bildande av nätverk och forskningssamarbete, skapa förutsättningar för långsiktig forskning och nya forskningsinitiativ, effektivisera användningen av forskningsresurser och förbättra forskningsinfrastrukturen samt rikta forskningsfinansiering till rationell läkemedelsbehandling.

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Table of contents

1 Foreword

In accordance with Prime Minister Juha Sipilä's Government Programme, the Government is carrying out an implementation programme for rational pharmacotherapy. The programme is aimed, for example, at enhancing implementation of holistic treatment, improving people's functional capacity and creating the preconditions for cost-effective pharmacotherapy from the point of view of both patients and society (Prime Minister's Office 2015).

The implementation programme for rational pharmacotherapy and its objectives by 2022 are described in the final report of the programme (Ministry of Social Affairs and Health 2018). The reports of the working groups involved in the drafting of the implementation programme for rational pharmacotherapy are published at the same time. Each one of them focuses on a different theme and provides more in-depth information about it.

This research strategy has been drawn up as part of the implementation programme for rational pharmacotherapy. Background documentation includes the Ministry of Social Affairs and Health's ‘Medicines Policy 2020’, which defines the national objectives for the pharmaceutical sector by 2020 (Ministry of Social Affairs and Health 2011).

The document emphasises the role of the pharmaceutical services as part of the healthcare and social services system, and the customer-centred approach in the activities of the pharmaceutical services. The research strategy takes also account of the government programme key project for improved home care for older persons and enhanced informal care in all age groups (Ministry of Social Affairs and Health 2018b). Strengthening overall assessment of medical care is also a part of this key project.

Pharmacotherapy is a central treatment method in various conditions. With a view to successful treatment outcomes, it is important to aim for rational pharmacotherapy that is effective, safe, economical, equal and of high quality (Ministry of Social Affairs

and Health 2018a). However, pharmacotherapy is not always rational. Pharmacotherapy and its management need to be developed to ensure successful treatment outcomes and functional implementation processes for pharmaceutical treatment.

Pharmacotherapy and its implementation must be based on research and good clinical practice. Research is needed on the efficacy and effectiveness of pharmacotherapy and the practical management of pharmacotherapy. Research focusing on rational pharmacotherapy allows us to identify areas for development in the pharmacotherapy processes and improve the safety of pharmacotherapy. With the help of research, we can also monitor the impacts of administrative decisions, care recommendations and other measures, as well as the use of resources. Cooperation between various stakeholders and well-functioning monitoring systems are required to produce high-quality research data and to develop relevant activities.

The objectives of this research strategy are 1) to identify and describe research areas for the implementation of rational pharmacotherapy, 2) to find methods to promote utilisation of research data in the management of rational pharmacotherapy, 3) to increase research cooperation and enhance preconditions of research and 4) to identify needs for new research initiatives and methodological development.

The research strategy supports the realisation and monitoring of the implementation programme for rational pharmacotherapy by targeting research to such areas of research that are essential from the perspective of rational pharmacotherapy. The objective is to produce scientific advice that serves the implementation of rational pharmacotherapy in practical patient work as well as in the planning of health and social services at national, organisational and regional levels. The research strategy is intended as a support document for researchers, research groups, research organisations, and health and social services organisations in their planning work. It is also hoped that the strategy would serve the needs of research funding providers in the targeting of research funding.

1.1 How Was the Research Strategy developed?

The preparation of the research strategy was performed by the working group on research for the implementation programme for rational pharmacotherapy (Appendix 1). The strategy draws on the draft document drawn up earlier by the Finnish Medicines Agency Fimea in 2015 and the statements received on it. When compiling the strategy, account was taken of the existing research information, and the new research

needs and methodological development needs that came up in connection with drawing up the implementation programme for rational pharmacotherapy.

To map out the existing research data, in spring 2017 the working group conducted a review of research related to rational pharmacotherapy in Finland. The group sent an open invitation to researchers and research networks for wide distribution via the Ministry of Social Affairs and Health, urging people to pass it on. The invitation was also published on the Fimea website. In the invitation, researchers and research groups were asked to briefly describe their own research projects related to rational pharmacotherapy and the most important research publications made on them. At the same time, researchers were asked to report if they were interested in joining the research network of rational pharmacotherapy to be established.

In the various stages of working on the research strategy, the group took account of the feedback received from the steering group of the implementation programme for rational pharmacotherapy. Furthermore, the draft strategy underwent a public consultation round in autumn 2017.

1.2 Current State of Rational Pharmacotherapy Research

1.2.1 What are the Research Topics?

Based on the review and other information gathered by the working group on research for the implementation programme for rational pharmacotherapy, the research data available is focused on the following areas:

- Most of *the research done on the use of medicines* has focused on the use of medicines among the elderly, as well as the inappropriateness, problems and risks of pharmacotherapy, using pharmacoepidemiology research methods and registers. In recent years, studies searching ways to identify, manage and prevent problems caused by pharmacotherapy have become more common. The methods used have included research on the impacts of multidisciplinary cooperation and the assessments of medical care, the development of identification tools for medication risks, and enhancement of the medication competence of healthcare and social services personnel as well as improvement of the basic, continuing and specialist training to this end.

- *Pharmacoepidemiology* research has produced basic information on the trends in the use of medicines, and results of such research have been published annually in the Finnish Statistics on Medicines (Finnish Medicines Agency Fimea and Kela 2016). Other studies have compared the use of medicines in accordance with such variables as gender, age, hospital district and the degree of specialisation of the attending physician. The research has increasingly shifted to combining information on the use of medicines with data gathered from other registers, which allows the use of epidemiological methods for recognising factors associated with the use of medicines, and identifying health benefits and risks caused by medicines. In recent years, research has included such topics as the pros and cons of statins, the impacts of exposure to medicines during pregnancy, the effects of pharmacotherapy on the development of memory disorders and the state of health of those suffering from memory disorders, and the connection between medication and cancer morbidity.

- *Pharmacokinetic research for the promotion of pharmaceutical* safety is focused on studying drug interactions and their mechanisms, and more recently, the impact of genetic factors on the drug response and taking it into account when planning individual pharmacotherapy.

- *Research related to pharmaceutical safety* has studied such subjects as the implementation of the EU Pharmacovigilance Directive, which came into effect in 2012. An area of particular research interest has been how medication users themselves participate in reporting adverse drug reactions, on one hand, in EU countries with a long tradition of user participation, and, on the other hand, in countries where user participation began with the entry into force of the directive.

- *The quality and accessibility of medicines information, and medicines information practices* have been studied in different operating environments. Most of the studies have focused on the councelling practices in pharmacies. In addition, quite a few studies have been made on the sources and need of medicines information among the general population and healthcare professionals, and the medicines education of children. The focus of research is shifting to empowerment, literacy in medicines information, and the impressions people have of conditions and their drug treatment as factors affecting their medication-taking behaviour. In addition, researchers have tried to find methods for studying the effectiveness of medicines information. Research on medicines information and its application has been enhanced as part of Fimea's Medicines Information Strategy with the help of the Medicines Information

Network (Finnish Medicines Agency 2012, Järvinen et al. 2013, Medicines Information Network 2016, Mononen et al. 2018).

- *System-based medication safety research* was launched in Finland as part of the national patient safety work (Ministry of Social Affairs and Health's Steering Group for the Promotion of Patient Safety 2006–2009, Turvallinen lääkehoito guidelines on safe pharmacotherapy 2006, National Institute for Health and Welfare's patient safety programme Potilasturvallisuutta taidolla 2011–2014). Based on the research review conducted in 2015, a total of 18 peer-reviewed Finnish medication safety research papers have been published (Hakoinen et al. 2017). Several studies in different operating environments are currently under way, establishing various lines of research. Furthermore, several theses and different research and development reports have been made on the subject. The increased use of medication incident reporting systems in the health and social services organisations has stimulated research as well. A lot of medication incidents related to distribution, administration and documenting of medications have been reported. Therefore, organisations have begun to develop new operating practices for these functions using such tools as updated patient-specific medication lists and electronic dispensing systems. However, there is very little reported data available on medication incidents related to prescribing drugs and the need of drug therapy from all operating environments. Both in Finland and internationally, the focus in the medication safety research is shifting towards supporting proactive medication safety work and safety culture by means of, for example, identifying high-risk medications and situations in different operating environments and specialities, and, based on them, drawing up safeguards and making the implementation processes of pharmacotherapy safer (WHO 2017).

- *The impacts of medicines policy decisions* have been studied from various perspectives, such as generic substitution from the viewpoints of society, medication users, physicians and pharmaceutical supply chains. Assessments have been made on the impacts of the introduction of electronic prescription system on the prescribing and supply of medicines, and medication safety. Research has also been conducted on the impacts of the changes in the medication reimbursement system, the introduction of biological medicines and the relevant decision-making, and the availability of medicines. The legislative amendment that led to extending the sale of nicotine replacement products from pharmacies to other outlets has been assessed as a political process.

- Intervention studies for examining the *effectiveness* of rational pharmacotherapy in different operating environments have become more common. The purpose of such research is to produce new information with a view to developing new operating practices. Research has been carried out on such issues as the effectiveness of pharmaceutical services, multidisciplinary assessments of pharmacotherapy, safety checks and automated drug dispensing systems. Furthermore, intervention studies have been conducted to investigate what would be functional means for, for example, reducing long-term use of sleeping pills and antipsychotics among the elderly. In the field of comparative effectiveness research, hospital districts and their units – hospital pharmacies, for example – have taken the initiative and produced information for the development of their own activities and decision-making processes.

  Some register-based observational studies have also been conducted on the effectiveness of pharmacotherapy, which is becoming more common due to the development of register data and research methodology.

- *Pharmacoeconomic research* is quite a new field of study in Finland and it is seeking a position as part of the comparative effectiveness research on healthcare. Pharmacoeconomics applies the methods of health economics for studying phenomena related to pharmacotherapy. Over the past few decades, the competence in pharmacoeconomic research methods and their introduction to use has increased, and a few educational and research units with their own lines of research have been established.

  In Finland, pharmacoeconomic research has been carried out on, for example, the impact of pharmacotherapy on the patient's and his or her family member's quality of life when treating memory disorders, and the cost-effectiveness of biological medicines and traditional rheumatoid arthritis medications when treating rheumatic diseases. In addition to actual pharmacoeconomic research, the methods of evidence synthesis and economic assessment are applied, for example, by authorities. Examples of this are submission files and the health economic evaluations required for the decisions on the reimbursement status and wholesale price of medicinal products made by the Pharmaceuticals Pricing Board produced and Fimea's assessment of the therapeutic and economic value of medicines. Systematic literature reviews have become more common in scientific research particularly as part of theses.

1.2.2 Where Is Research Conducted?

The rationality of pharmacotherapy is studied at universities, particularly in the fields of medicine, pharmacy and nursing science, sector research institutes, hospital districts and universities of applied sciences providing education in healthcare.

Research supporting rational pharmacotherapy is also included among the statutory duties of various authorities. For example, the Social Insurance Institution of Finland (Kela) carries out research serving the development needs of the benefits systems and Kela's own activities on a statutory basis (Act on Social Insurance Institution 731/17 August 2001), which in case of reimbursements for medicines means research related to the reimbursement system for medicine expenses and use of medicines. Furthermore, the register data collected by Kela and the methodological competence related to their use at Kela Research are important for other parties conducting register-based research. Kela also finances research on rehabilitation, prevention of illnesses and health insurance pursuant to the Act on the rehabilitation benefits and rehabilitation allowance provided by the Social Insurance Institution (566/15 July 2005). It has played an important role in the financing of research promoting rational pharmacotherapy.

In addition to its duties as a licensing and supervisory authority, Fimea has been assigned specific research and development duties, including the implementation of pharmacoepidemiology and pharmacoeconomic research and research related to medicines policy (Act on the Finnish Medicines Agency 593/24 July 2009). Furthermore, Fimea is tasked with building cooperation within the fields of research mentioned above.

The statutory duties of the National Institute for Health and Welfare include the research, monitoring and promotion of the health and welfare of Finnish people and the reduction of relevant problems, as well as conducting research and development activities within the sector for the promotion of national health and welfare (Act on the National Institute for Health and Welfare 668/31 October 2008).

Research is also conducted in hospital districts, hospitals and other health and social services organisations, pharmacies, hospital pharmacies and the pharmaceutical industry. State Research Funding (VTR, formerly Special State Subsidy, EVO funding), based on the amount of scientific publications, has been an important source of funding for rational pharmacotherapy research and development in the healthcare sector. Most of this funding has been used for medical research and education, but also for R&D projects in, for example, nursing sciences and pharmacy. Multidisciplinary research projects through, for example, specialist training have become more common in recent years.

The pharmaceutical industry produces a lot of research data throughout the life cycle of a medicinal product. Some of this is issued as scientific publications, and some of it becomes public in connection with the marketing authorisation process and pharmacovigilance. However, major part of the research data is internal business information that is never published. Even after the marketing authorisation has been granted, the pharmaceutical company needs to supplement the research data related to a medicinal product. This research data is used, for example, for health economic evaluations that are attached to the application for the reimbursement status application. Research data may also accumulate in connection with adaptive pathways and conditional licensing procedures, fulfilment of the obligation to provide information potentially related to conditional reimbursement decisions or in connection with pharmacovigilance. In addition, companies may need to monitor the targeting of the use of a medicinal product and treatment in large patient populations and to identify patient groups who benefit the most from the treatment.

1.2.3 Current State of Research: Strengths and Opportunities, Weaknesses and Threats

The assessment of the current state of research on rational pharmacotherapy is shown in table 1. Versatile and multidisciplinary research in rational pharmacotherapy of high scientific standard is being conducted in Finland. It is utilised in both decision-making on medicines policy and in practical promotion of rational pharmacotherapy.

In the future, the new data produced by the health and social services information systems will offer new opportunities if it can be effectively harnessed for research use. Enhanced collaboration between research groups and participation of health and social services regions in the production of research data and its application are also important future opportunities. Increasing interdisciplinary and multidisciplinary research cooperation enables the study of rational pharmacotherapy from novel perspectives. Particularly, the observation of the theories and methodologies of social and behavioural sciences in research supporting rational pharmacotherapy is an important opportunity that could be used for strengthening understanding of the patient's perspective as well as the operating models.

As weaknesses, we can consider scarce research funding and lack of other resources. There is also room for development in the targeting of research to areas that are essential from the perspective of rational pharmacotherapy. Not much research has been conducted from the patient's perspective, even though the need for such research is substantial. It can be considered a threat that research promoting rational

pharmacotherapy will continue to be regarded as a marginal discipline, and no resources can be found for conducting such research. In order for research infrastructure to function properly, it is required that resources are allocated for expert services to support researchers in, for example, information search, research methodology, statistics and data processing.

Table 1 The current state of rational pharmacotherapy research: strengths and opportunities, weaknesses and threats

STRENGTHS	WEAKNESSES
- Versatile and multidisciplinary rational pharmacotherapy research is conducted in many different places, where established research groups have emerged. - The research conducted is of high scientific standard. - Research is utilised for decision-making on medicines policy, for example when drafting legislation. - Research is used for promoting practical work, for example when developing operating models, tools and information systems.	- There is very little long-term research. - Research groups are small and operate in isolation from each other. The number of senior-level researchers is small. - Funding and other resources are scarce. Research infrastructure is insufficient. - There is room for improvement in the research methodology competence. - Cooperation with researchers, health and medicines policymakers and health and social sector actors is unbalanced. → room for improvement in the application of academic research information in particular. - From the perspective of rational pharmacotherapy, the focusing of research is unbalanced. For example, relatively few studies have been conducted on initiating medication, whereas the number of studies on the use of medicines is much higher. The number of studies conducted from the patient's perspective is small.
OPPORTUNITIES	**THREATS**
- The new information produced by health and social services information systems and biobanks that can be utilised for research purposes. - Enhancing cooperation between research groups → joint funding, multidisciplinary research groups and research data of higher quality. - Research will become part of the duties included in the health and social services system, and the health and social services regions will participate in the production and utilisation of research information. - Interdisciplinary and multidisciplinary research and new research initiatives. - Promotion of the quality of pharmacotherapy and medication safety by means of, for example, promotion of evidence-based pharmacotherapy and drug treatment practices.	- Research projects remain undone or they are discontinued due to scarce resources or fragmentation. - Research competence weakens. - From the viewpoint of science policy, pharmacotherapy is a marginal field of research. - Insufficient communication of the meaning of rational pharmacotherapy research to funding providers and users of research data. - Research is dropped out of the duties of the health and social services system.

- Finding ways for curb the rise in medication expenditure and increasingly precise targeting of pharmacotherapy. - Development of social, technological and service innovations that support the implementation of pharmacotherapy. - Utilising artificial intelligence in support of clinical decision-making and generation of academic research materials, with the data recorded in patient records and biobanks serving as the basis.	

2 Vision and Goals of Research

Research data is used for promoting rational pharmacotherapy and safe pharmacotherapy practices. The motto is: *Promoting effective use of research information in the implementation of rational pharmacotherapy.*

By the year 2022

- the research and development related to rational pharmacotherapy has been integrated into the operations of the health and social services system,
- research results are utilised diversely in steering the activities in the health and social services system and in making decisions on medicines policy and
- research and allocation of resources to the key research areas presented in the research strategy are strong.

3 Key Research Areas and Themes

The key research areas and themes with a view to implementation of rational pharmacotherapy have been collected into figure 1, which serves as the foundation of the research strategy. The research areas summarised in the figure correspond with Donabedian's (1997) principles of the factors affecting the quality of care. Some of them are related to structures and operational preconditions, some to implementation processes of care, and others to the impacts and effectiveness of care.

When applying the Donabedian model to rational pharmacotherapy, the key research areas and themes are: 1) the structures and operational preconditions supporting rational pharmacotherapy, 2) implementation processes of pharmacotherapy promoting medication safety and 3) the effectiveness of pharmacotherapy (figure 1).

These three main research areas can be divided into more exact research themes and detailed objectives, which are based on the definition of rational pharmacotherapy (WHO 1987, Ministry of Social Affairs and Health 2018a) (figure 1).

Therefore, by means of research we seek to promote the development of structures and processes, and to monitor the impacts and effectiveness of pharmacotherapy, taking into account the goals of rational pharmacotherapy.

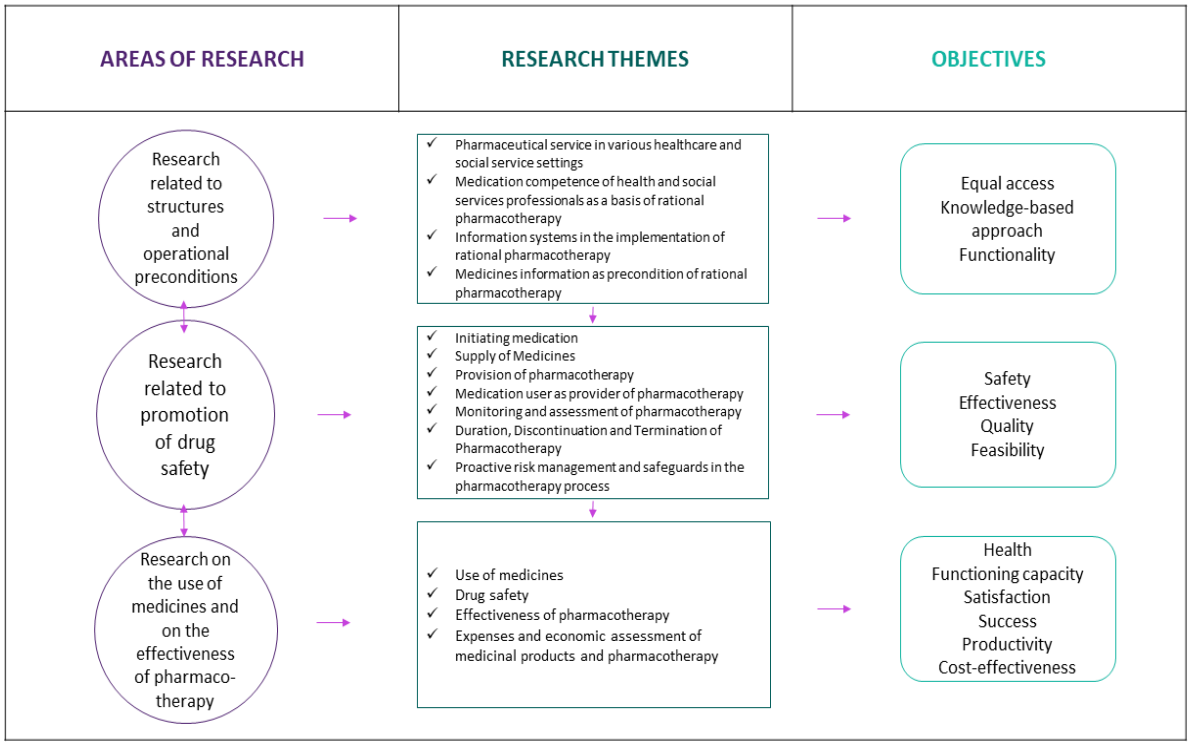

Figure 1 A model illustrating the implementation of rational pharmacotherapy, presenting the identified key research areas and themes in relation to the goals of rational pharmacotherapy. The research strategy is built in accordance with the figure.

The research themes presented in figure 1 are described in more detail in the following chapters. The descriptions take into account the research needs that came up during the preparation of the implementation programme for rational pharmacotherapy in relation to the existing research data and the research methods used. The description of each research theme is followed by a list of research topics. The lists are not all-inclusive, but they suggest important research areas and needs for targeting research from the viewpoint of the implementation programme for rational pharmacotherapy.

3.1 Research Related to Structures and Operational Preconditions

The themes of research related to structures and operational preconditions can be divided into four parts: 1) the pharmaceutical service system, 2) medication competence of health and social care professionals, as well as 3) information systems and 4) medicines information, which can be used to support the implementation of rational pharmacotherapy in various healthcare and social services settings (Figure 1).

3.1.1 Pharmaceutical Services in Various Healthcare and Social Services Settings

According to the existing research data, the management of pharmacotherapy as a whole is one of the biggest challenges of the rational pharmacotherapy. The ongoing health and social services reform allows examination of the structures of pharmaceutical services and mobility of data between, for example, various operating units and organisations. With the help of well-functioning structures, it would be possible to ensure that pharmaceutical services provides optimal support for the implementation and overall management of pharmacotherapy in various health and social services operating units in the public and private sectors as well as in the third sector.

It is important that the continuation and monitoring of necessary drug treatment is implemented in a seamless manner when a patient/client moves from one unit or professional to another in accordance with his or her individual treatment pathway. That requires patient/client-specific treatment pathways and well-coordinated practices that should extend to use and monitoring of drug treatment. From the pharmaceutical services this requires not only efficient pharmaceutical logistics but also solutions promoting the therapeutic quality of pharmacotherapy and medication safety, and clinical pharmacy services.

As the health and social services system and drug therapies develop further, the interface between inpatient and outpatient care is expected to dissipate. The digitalisation of the health and social services system is aimed towards the same goal. For medication users and patient care team members digital services enable a new kind of participation in the implementation and monitoring of the impacts of pharmacotherapy. The potential freedom of choice will change for its part the way people behave when using health and social services and pharmaceutical supply services, which will become visible in the implementation of pharmacotherapy. This will increase the pressure to change the present multisource financing system of pharmaceutical services.

The planned changes in the health and social services described above need to be supported by research, where pharmaceutical service is examined as part of the health and social services system from a totally new perspective and as a provider of new kind of pharmaceutical supply services for health and social services. The study should assess the tasks, cooperation, operational preconditions and cost-effectiveness of the current public pharmaceutical supply services (the existing hospital pharmacies and pharmaceutical centres of hospital districts) and the pharmaceutical supply services of private outpatient care (outpatient pharmacies) as part of the health and social services system. At the same time, it should be examined how the pharmaceutical services of other health and social service providers has been arranged, how

it functions and how it could be integrated into/coordinated with other pharmaceutical supply services.

Documentation that could be used as a starting point for research include the policies presented in the Ministry of Social Affairs and Health's 'Medicines Policy 2020' and the policies drawn up by the various working groups involved, where the duties of pharmaceutical service in the health and social services structures is studied in closer detail (Voipio-Pulkki et al. 2013, Ministry of Social Affairs and Health 2015). The latest policies for the development of the pharmacy system were drawn up by the working group to develop pharmacy operations set up by the Government in 2017 (The policy lines of the working group of government parties to develop pharmacy operations 2017). New research data and the earlier research data collected systematically is needed as background information for the implementation of decisions, for monitoring the impacts and cost-effectiveness of changes, and for reacting to changes, if necessary.

Research Topics

- The development of the tasks, structures and services of pharmaceutical service to respond to the needs of the health and social services system and citizens in the implementation of rational pharmacotherapy.
- The coordination of pharmaceutical service in inpatient and outpatient care.
- The expansion of pharmaceutical service from efficient pharmaceutical logistics to solutions promoting the therapeutic quality of pharmacotherapy and medication safety, and to clinical pharmacy services.
- The funding, effectiveness and cost-effectiveness of pharmaceutical service.
- The functionality of pharmaceutical service and supply of medicines under normal conditions and in crisis situations.

3.1.2 Medication Competence of Healthcare and Social Services Professionals as a Basis of Rational Pharmacotherapy

The medication competence of healthcare and social services professionals lays the foundation for rational pharmacotherapy and medication safety. The medication competence provided during basic training includes the readiness to provide counselling to medication users and self-care guidance, to monitor drug treatment and to collaborate multiprofessionally. With the help of research, it is possible to examine the medication competence of various healthcare and social services professionals and the sufficiency of training in the development of such skills. In addition, research should

be targeted to finding new methods for developing medication competence at workplaces by, for example, enhancing self-study and interprofessional learning with the help of digitalisation and web-based learning. More research data is also needed on how practical use of this knowledge could be promoted. For example, the WHO has drawn up an extensive training programme in multiprofessional patient safety that also includes a medication safety aspect (WHO 2011 and 2017).

Research Topics

- The medication competence of various healthcare and social services professionals in relation to work tasks and drug treatment responsibilities.
- The development needs of training related to content of teaching and teaching methods.
- The opportunities provided by digitalisation in the basic and continuing training, workplace-specific training and self-study related to rational pharmacotherapy.
- Learning organisations from the viewpoint of the implementation of rational pharmacotherapy (participatory action research).
- The need of coordination in pharmacotherapy training and the methods for implementing coordination.
- The impact of interprofessional training on medication competence, medication safety, patient welfare and satisfaction, patient's quality of life and care expenditure.

3.1.3 Information Systems in the Implementation of Rational Pharmacotherapy

Healthcare information systems, such as client and patient information systems, are important tools for healthcare professionals and medication users in the implementation of rational pharmacotherapy. The activity of citizens in the management of personal welfare, self-care and treatment adherence can also be promoted by means of improving the management and flow of information, and by increasing the provision of electronic services and remote connections. Malfunctioning information systems, on the other hand, endanger patient and medication safety and may lead to serious adverse events. Therefore, the usefulness and effectiveness of these new data management and care applications in the pharmacotherapy should be studied more than is currently done. They constitute one subject of health technology assessment, the importance of which will increase significantly in the provision of health and social services.

The health and social services system is currently undergoing extensive information system and data management reforms. One of the most important reforms that have already been implemented is the introduction of an electronic prescription system. It has changed, for example, the way data is stored, as well as the opportunities of both healthcare professionals and patients to examine the medication prescribed and renewal of prescriptions. It is also still important to study how the electronic prescription systems works so that its properties could be developed further from the perspectives of both healthcare professionals and medication users. One such research subject is the electronic renewal of prescriptions and its impact on rational pharmacotherapy.

Electronic prescriptions are part of the National Archive for Health Information (Kanta), where healthcare units record patient data from their own information systems in a data secure way. This information is available to all healthcare units. In the My Kanta online service, patients have access to their own patient records, including all care and medication data. In the future, they can also personally enter data on their own state of health and care into My Kanta. The goal is that, in the future, Finland would have a uniform national medication list in shared use. All parties participating in patient care and, using My Kanta, the patient himself or herself could view the medication list in the same format. To bring these new data management systems to optimal use, research data is needed on such issues as how citizens learn to use the system and actively record their health information as part of self-care. On the other hand, it is important to use research for identifying population groups with no opportunities to use electronic patient information systems and other services supporting pharmacotherapy.

Different risk management tools (e.g. drug interaction databases and databases on drugs suitable for the older persons) and decision-making support systems have been developed and adopted both in Finland and abroad to provide support for physicians in their prescribing activities and for the risk assessment of pharmacotherapy. At best, decision-making support systems combine the patient's health information collected from electronic patient records to medical data, and produce operating and care instructions tailored for the patient in question. These databases are widely available in Finland throughout the health and social services system and pharmaceutical service. However, the integration and use of databases does not yet happen in an optimal fashion in the existing patient information systems. Research data would be needed on, for example, how people are able or capable of using the databases in care work, how their use can be promoted, and what their effectiveness is like.

The development of healthcare information systems is part of the national ‘Health and Social Services Data to Effective Use’ strategy (Ministry of Social Affairs and Health, and Association of Finnish Local and Regional Authorities 2014). The Kanta services and new health applications open new opportunities for not only developing care but

also for research on the effectiveness of pharmacotherapy and medication safety. Storage of data in structured format is important with a view to the usability of documented data, patient care and research use.

Research Topics

- The digitalisation of health and social services and the accessibility, usability, utilisation and effectiveness of information systems in the promotion of rational pharmacotherapy in health and social services, taking account of the needs of the users and the operating environment about to change as a result of the health and social services reform.
- Remote connections, as well as self-care and self-management services increasing the activity of citizens in the maintenance of their own wellbeing, and their effectiveness and usability in the promotion of rational pharmacotherapy in healthcare.
- The usability and effectiveness of the health information personally recorded by patients.
- The use of patient information system data as research material for studies on the patients' medication use, treatment adherence and the effectiveness of pharmacotherapy.
- The usability of artificial intelligence in the processing of clinical, electronic patient record data as a tool for decision-making and monitoring of care, and as a research tool.

3.1.4 Medicines Information as Precondition of Rational Pharmacotherapy

Easily accessible evidence-based medicines information provided in a suitable format is one of the structural preconditions of rational pharmacotherapy and medication safety (Ministry of Social Affairs and Health 2011, Finnish Medicines Agency Fimea 2012). Medicines information helps medication users acquire sufficient competence and coping skills needed for successful pharmacotherapy. This requires high literacy in health and medicines information, the achievement of which should be supported in schools, for example.

Consumers and medication users have access to increasing amounts of different sources of information, which they can use independently to search for the information they need on illnesses and their treatment. Even though active support has been provided for independent search of medicines information, particularly physicians and pharmacists still have a strong position as sources of medicines information.

With a view to supporting successful pharmacotherapy outcomes for patients, it is essential that healthcare and pharmaceutical service professionals have access to reliable information sources and services that they are capable of using. Professionals also need good communication skills and clinical interview skills for customer-oriented counselling. The medication counselling provided by various professionals should be harmonious and mutually complementary, and it should be based on national recommendations and local agreements. The preconditions for this are provided by shared diseases and medication databases widely available within healthcare and pharmaceutical service, as well as medicines information services. The importance and effectiveness of these databases and services for the promotion of rational pharmacotherapy should be studied more than is currently done. This research data could also be used for the planning of the accessibility and quality of medicines information and medicines information services in the health and social services reform.

One important part of medicines information consists of the medicines information produced by the pharmaceutical industry for marketing purposes. Very few studies have been conducted on it either in Finland or internationally. Research data would be needed on the effects of pharmaceutical marketing on the formation of the impressions of health and medicines, and the increase in the need for drug treatment (medicalisation). The rapid increase in the number and versatility of marketing channels in social media in particular increases the need for research.

The medicines information network and its research group have drawn up an updated strategy on research policies for medicines information until 2020 (Medicines Information Network 2016).

Research Topics

- Access to and literacy in medicines information among general population.
- The quality, availability, accessibility and usability of medicines information in health and social services and pharmaceutical service.
- The risk management tools of pharmacotherapy from the perspective of medicines information.
- The information needs and sources related to the medicines among healthcare and pharmaceutical service professionals and general population/medication users, the search strategies for medicines information and the use of such information.
- The use of electronic data sources and enabling their use, novel methods of communication.

- The need of and access to medicines information in special groups, such as people with memory disorders, the mentally disabled, sign language users, the visually impaired and immigrants, and the usability of the existing medicines information in different patient groups.
- The implementation of national recommendations for medication counselling in the new health and social services structures to support successful pharmacotherapy outcomes of patients, from the perspective of patients in particular.
- The effectiveness of medicines information and medicines information services.
- Pharmaceutical marketing as a factor affecting prescribing and use of drugs.
- The methods and information contents of pharmaceutical marketing.

3.2 Research Related to Promotion of Medication Safety

The implementation of pharmacotherapy is part of rational pharmacotherapy and a factor with decisive influence on treatment outcomes (WHO 2017). In this research strategy, the implementation of pharmacotherapy is examined as a patient-oriented process in different healthcare and social services settings.

The implementation of pharmacotherapy includes the following main stages, with varying areas of focus in accordance with the setting: 1) initiating medication, 2) dispensing of medicines, 3) provision of pharmacotherapy, 4) user perspective, 5) monitoring and assessment of pharmacotherapy, 6) duration, discontinuation and termination of pharmacotherapy and 7) proactive risk management and safeguards in the pharmacotherapy process (Figure 1).

3.2.1 Initiating Medication

There are various sub-processes associated with initiating medication, such as making the diagnosis, selecting the treatment suited for the person in question, assessment of the need for medication, prescribing drugs (writing the prescription), explaining the drug therapy to the medication user or his or her representative to the extent deemed necessary at the time the drug is prescribed, and agreeing on the follow-up of drug therapy with the medication user and other parties participating in the provision of drug therapy (e.g. Routasalo et al. 2009, Kekäle 2016).

The following factors have an effect on how the initial stage of the use of medication proceeds: is the patient starting a new medication, does the present medication continue or is a drug regimen replaced with another one. Many other factors, such as the patient's medical conditions, treatment motivation, state of health, life situation and the ability to take responsibility for personal drug treatment, also affect initiation of medication. Furthermore, the circumstances around initiating medication and the operating environment play an important role. Factors affecting how successfully drug treatment begins include diagnostics and the establishment of the need for medication, the time reserved for going through the matters related to the medication during appointment, the tools available, information sources and systems, and documentation of medication decisions.

Plenty of international research has been done on the prescribing practices of drugs and the factors affecting prescribing decisions. On the other hand, less research has been conducted on the importance of the initial stage of medication from the perspective of patient safety, which the WHO has just recently urged us to pay more attention to (WHO 2017). In a systematic literature review that examined factors causing serious medical errors in primary healthcare, the making of diagnosis and writing the relevant prescriptions as well as insufficient monitoring of pharmacotherapy arose as issues endangering patient safety (Panesar et al. 2016).

In Finland, very few studies have been conducted on the prescribing practices of physicians and nurses with limited prescribing rights, and factors affecting prescribing decisions. The information gathered from Kela's prescription archives gives an overall impression of the prevailing trends in prescribing and use of drugs, but more research data is needed on the initiation and repeat prescribing of medication, and the factors affecting how the prescriber operates.

Studying the initiation process of drug treatment is important also because the tools and databases assisting in the initiation process have developed and become more versatile, enabling planning of patient-specific medication. They also promote proactive risk management in pharmacotherapy. The challenges posed by electronic tools and processes are their fragmentation, their laborious use, as well as how adept the prescribers are in using them when making medication decisions. Therefore, more research data is needed to develop these innovations further and put them into practice. On the other hand, information is needed on the impacts of electronic databases and decision-making support system as well as electronic prescriptions and the Kanta services on prescribing of drugs and rational pharmacotherapy.

The amended Decree on Prescriptions (1088/2010), which entered into force at the beginning of 2017, increased the prescriber's responsibility for ensuring the necessity of the drug treatment prescribed by him or her and taking account of its costs. At the

same time, the period of validity of prescriptions was extended from one year to two years, which is a major change in the implementation practices of pharmacotherapy. It increases the pressure to delegate the responsibility for the monitoring of pharmacotherapy from those who initiate it to other healthcare and pharmaceutical service professionals. This increases the need for closer multiprofessional collaboration across health and social services particularly as regards long-term drug therapies (see chapter 3.2.5 Monitoring and Assessment of Pharmacotherapy for more details).

In addition to research on the prescribing process of medication, more research data is also needed on the prescribing and repeat prescribing processes regarding specific patient groups and certain medicines/medication groups. Such patient groups include the elderly and people with multiple conditions or other patients for whom it is more challenging than usual to plan an individual medication regimen and other patients with challenges in pharmacotherapy. The specific medication groups include antipsychotics, analgesics and antimicrobial agents, high-risk medicines and expensive drug therapies, where treatment decisions must be made after careful cost-effectiveness considerations.

The prescribing practices of nurses with limited prescribing rights should also be studied. It should also be studied how pharmacists participate in the initiation of medication and repeat prescribing and how this affects medication safety (e.g. they review the medicines the patient is using, update the medication list information, perform a medication ‘safety check’ and interview the customer on how well the drug therapy has succeeded).

Research Topics

- Research and understanding of the prescribing process: making the diagnosis and differential diagnosis, establishing the need for medication, making the decision on drug treatment and selecting the drug, taking into account the evidence-based pharmacotherapy and other individual factors affecting the choice. Deciding on the duration of drug treatment.
- The usability of electronic databases and decision-making support systems intended to provide support for prescribers in their decision-making, when planning patient-specific drug therapies, and the effectiveness of such tools for rational pharmacotherapy and curbing medication expenditure.
- The prescribing practices of antipsychotics and analgesics, as well as medicines classified as narcotics and how these can be affected.
- Prescribing high-risk medicines.

- Pharmacotherapy and prescribing practices of vulnerable patient groups, such as children, pregnant women, the elderly, persons with multiple conditions, the disabled and people with rare diseases.
- Prescribing expensive drug therapies and financial planning of pharmacotherapy in practice.
- The impact of the patient's financial situation and the drug reimbursement system on prescribing drugs.
- Counselling and collaboration with the patient when initiating or continuing the medication.
- Multiprofessional collaboration and flow of information in various phases of pharmacotherapy, particularly when initiating medication, deciding on the continuation of medication, in repeat prescribing and in problem situations.
- Studying the social factors affecting how the prescriber operates from the viewpoints of the rationality and expenses of pharmacotherapy (e.g. pharmaceutical marketing, social media, health and medicines policy decisions).
- The impact of prescribing practices on the medicalisation and iatrogenesis.
- Monitoring of the impacts of the updated Decree on Prescriptions.
- Relaunching the monitoring and research activities on rational use of antimicrobial agents launched with the MIKSTRA project at the turn of the century.
- The implementation and quality of prescribing by nurses with the limited prescribing rights.
- Understanding and observation of the organisation-based factors affecting initiation and continuation of medication in the promotion of rational pharmacotherapy (e.g. use of medication incident reports, implementation research, safety culture research).

3.2.2 Dispensing of Medicines

1) Community Pharmacies

The key task of community pharmacies is to dispense both prescription drugs and over-the-counter (OTC) medications to the persons in outpatient care who need medication. Today, the clients of such pharmacies increasingly use methods other than personal visits to take care of their business (e.g. doing business through an online pharmacy, an agent or home care). Regardless of the way business is done, when dispensing drugs, the pharmacy is obliged to ensure the safety of pharmacotherapy and the correct use of medicines (Medicines Act 395/1987).

Administrative regulation for dispensing medicines assign minimum duties for pharmacies for checking that the prescription provides sufficient information on taking the drug, and on the duration and purpose of use of the drug treatment. At the pharmacy, this data must be transferred to the user in writing on an instructions label, and it must be communicated to the user when handing out the medicines or in some other way. In addition, many pharmacies routinely check, for example, drug interactions of importance for treatment.

The most researched area of the dispensing process at community pharmacies is medication counselling. The objective has been to study how well medication counselling is integrated into the normal medication dispensing process and thus ensure not only the fulfilment of the pharmacy's counselling obligation but also the quality of counselling from the customer's point of view by means of, for example, pseudo customer studies. The reliability of delivery at pharmacies has been monitored on a regular basis. In addition, relatively numerous studies have been conducted on professional services supporting successful pharmacotherapy provided by pharmacies, the development needs of information management at pharmacies and the functionality of the electronic prescription system.

In the future, the new health and social services system will constitute the new operating environment for community pharmacies, with and alongside which they will function. The policy laid down in the Ministry of Social Affairs and Health's medicines policy document and the supplementary working group memorandums (Ministry of Social Affairs and Health 2011, Voipio-Pulkki et al. 2013, Ministry of Social Affairs and Health 2015) is that among the duties assigned to pharmacies increasing emphasis will be laid upon counselling on the use of medication, support for self-management and monitoring of pharmacotherapy, as well as financial planning of pharmacotherapy from the perspectives of the user and the payer. The duties of pharmacies as suppliers of medicines and in ensuring the appropriateness and safety of pharmacotherapy implemented among population in outpatient care within their area of operation (Medication Act 395/1987) will probably be extended in the future.

In the future, research should be targeted to studying how the dispensing of medicines from a pharmacy combined with prescribing constitutes a safe and appropriate entity from the perspectives of the medication user, prescriber, pharmacy and the rest of the healthcare system (cf. Fimea administrative regulation 2/2016). It is important that the prescriber and the pharmacy locally agree on measures promoting medication safety and rational use of medication, and controlling the growth of medication expenditure (e.g. assessment of the range of medicines from the perspectives of care recommendations and local needs, optimal use of information systems, agreeing on division of duties and responsibilities). Furthermore, it should be examined how the

stakeholders could agree on appropriate procedures for ensuring the quality of medicinal products and medication safety if the pharmacy is in charge of the supply of medicines to health and social services units.

The supply of medicines trough online pharmacy services was allowed in 2011 and it has brought new operating models using various service channels to outpatient supply of medicines. Their impacts on rational pharmacotherapy and the opportunities they provide for advancing it should be studied. Pharmacies have introduced electronic tools for medication counselling and risk management of pharmacotherapy (mostly the same ones that are in use also elsewhere in health and social services). More research is needed on their functionality, use and effectiveness in the promotion of rational pharmacotherapy and risk management of drug treatment. Extending the research on the reliability of delivery of medication to security of supply and the duties of pharmacies as part of Finland's security of supply work has emerged as a new area of research. Getting prepared for availability problems deriving from the operations of the pharmaceutical industry is part of this work.

Research Topics

- The duties and opportunities of pharmacies in the advancement of rational pharmacotherapy as part of the health and social services system.
- Treatment practices related to self-care, drug treatment prescribed by a physician/dentist/nurse with limited prescribing rights and promotion of health, and their effectiveness.
- The practices and effectiveness of medication counselling, support for self-management and monitoring of drug treatment in the promotion of rational pharmacotherapy.
- Dispensing of medicines through automated dose-dispensing: the need to develop practices to promote medication safety and effectiveness.
- Digitalisation of pharmacy operations and the effect of multichannel services (e.g. a pharmacy's brick-and-mortar store and online service) on the implementation and advancement of rational pharmacotherapy.

2) Hospital Pharmacies and Medicine Dispensaries

The delivery of medicines from hospital pharmacies and medicine dispensaries to wards has changed significantly over the past decade. The changes have been caused by, for example, organizational changes in the pharmaceutical service of hospitals and other health and social care units aimed at establishing bigger pharmaceutical service units, procuring drugs in larger batches, and more efficient pharmaceutical logistics. The use of automation has increased in the ordering of medicinal products to

wards and in their storage and reconstitution. With the closure of medicine dispensaries, many care organisations have lost their own pharmaceutical staff. On the other hand, in many other places the job description of the staff has become increasingly clinical and the number of staff has increased significantly.

The dispensing practices of medicinal products are still changing rapidly in Finland as new procurement and delivery systems are being introduced as part of the automation and digitalisation of healthcare. The new systems also promote medication safety, which is an important reason for adopting such systems. At the same time, part of the pharmaceutical staff transfers from logistics tasks to working in care teams to support the therapeutic quality of pharmacotherapy. In such change situations, it is important to conduct research by which processes of pharmacotherapy and the duties of the staff can be optimised, and the safety and effectiveness of new practices can be evaluated.

Essential medicines list has an established position in the implementation of the pharmaceutical service in hospitals and other facilities. The purpose of the essential medicines list is to steer choices of medicines and to influence the rationality of pharmacotherapy, but they also make pharmaceutical logistics simpler and more efficient. However, very few studies have been conducted on the use of such essential medicines.

Research Topics

- Optimising the ordering and dispensing practices at a regional level and in healthcare and social services organisations.
- Study of the changes in the dispensing processes of medicinal products in hospitals and other institutional care units of health and social services from the perspectives of medication safety and effectiveness.
- Integration of pharmaceutical logistics and the ward services of clinical pharmacy.
- The impacts of the basic selection of medicinal products at hospitals on the choice of medicines, pharmacotherapy and pharmaceutical logistics.
- Dispensing practices of expensive medicinal products with a view to optimising expenditure.
- The effects of new drug treatments and dosage forms on the dispensing practices and tailoring of drug therapies for different patients.
- The security of supply and operation of the pharmaceutical services of hospitals and other care facilities in emergency conditions.

3.2.3 Provision of Pharmacotherapy

As a rule, the provision of pharmacotherapy can be divided into inpatient or outpatient provision of drug therapy. In healthcare, inpatient care typically refers to care provided at hospitals, health centre hospitals and in residential homes for the elderly However, the division between inpatient or outpatient care is variable and sometimes also problematic because of the interface between private and public sectors. Increasingly demanding drug therapies are provided in outpatient care, such as at home, in assisted living facilities and in housing service units. Pharmacotherapy is also provided at many atypical places, such as schools, often without the presence of a healthcare professional.

Provision of pharmacotherapy includes the entry of medicinal products used by the patient/client into the patient information systems, keeping the medication data up to date, dispensing and administering medicines to the patient or taking care that the patient takes the medication intended for him or her (Inkinen et al. 2015). If necessary, the pharmacotherapy process also includes reconstitution of medicinal products.

Pharmacotherapy is provided in multiprofessional collaboration, where the areas of responsibility and tasks of each professional, and flow of information between the various actors, facilities and patients should be well defined and known by all parties involved. The patient's medication data being up to date and the transfer of information play a key role in safe pharmacotherapy (WHO 2017).

Deviations in the documenting, dispensing and administration of medication are the most common medication errors recorded in the medication incident reporting systems, such as the HaiPro system. The reporting of medication incidents and learning from the reported data has been one of the stimuli for setting out to reform the practices of pharmacotherapy in places like hospital wards. Former “medicine cups” have been replaced by electronic medication therapy management systems. There is already plenty of experience of such systems in other countries, but it would be important to study their effectiveness and functionality in Finland as well.

Medication therapies provided in hospitals differ significantly from outpatient drug therapies. Hospitals use a lot of intravenous drugs and solutions, antimicrobial agents, cancer drugs and analgesics the reconstitution, dosing and monitoring of which requires demanding competence. On the other hand, the morbidities of hospitalised patients pose extra challenges for safe of pharmacotherapy. Therefore, pharmacotherapy and its pharmacotherapy in hospitals should be studied more in Finland, using different research methods and, for example, data available in reporting systems.

In outpatient care, medication user himself or herself or his or her family members are mainly responsible for the provision of drug therapy. The pharmacists in pharmacies provide important support for this. They give advice and counselling on the use of medication when dispensing the prescription. Home care employees also often participate in the provision of drug therapies to older people in outpatient care in particular. Earlier studies have shown that the development of the healthcare system and the support provided by it have not been able to keep up with the transfer of the provision of pharmacotherapy to outpatient care. Therefore, more research is needed on the methods for promoting medication safety and on medication incidents particularly in homes, outpatient care and atypical settings.

Research Topics

- Research on the provision of pharmacotherapy and pharmacotherapy processes in various settings. Research should take account of the organisational viewpoint, associated with better use of medication incident data both methodologically and in terms of content, for example, identification of the contributing factors and root causes of the objects most susceptible to risk. Studying the safety, suitability and effectiveness of dispensing, administration, and documenting practices of medication and how medication is taken.
- Pharmacotherapy in atypical facilities and settings.
- Pharmacotherapy provided by home care.
- Collaboration within care teams, between care teams/care facilities and with the medication users and their family members.
- The impact of clinical pharmacy and clinical pharmacology services on the safe provision of pharmacotherapy and expenditure in different operating environments.
- Reconstitution of medicinal products at wards and in hospital pharmacies (e.g. the impact of automation on practices).
- Safety risks related to medicinal product packaging and product names.

3.2.4 Management of medications

In most drug therapies, the medication user personally acts as provider of pharmacotherapy. Therefore, medication users play a central and active role in the promotion of rational pharmacotherapy. The Finnish medicines policy also emphasises the patient's/client's own activity in the treatment of long-term conditions and symptoms that are easy to treat on one's own (Ministry of Social Affairs and Health 2011, Finnish Medicines Agency Fimea 2012). Still, there is very little information on pharmacotherapy from the patient's/client's perspective, even though it would be essential to ensure that appropriate support and monitoring systems could be built for the process of pharmacotherapy, when reforming the health and social services system. At the same

time, it should be better acknowledged what a vast potential and resource medication users themselves are and how this potential could be utilised better with the help of empowerment and participation.

In long-term medical conditions, the purpose of support for self-management and monitoring of drug therapy is to enhance the patient's adherence to treatment. The medication adherence is affected by several factors, such as factors related to the healthcare systems, care, the patient and his or her medical condition, as well as social and financial factors (e.g. WHO 2003). This is a major public health challenge, the root causes of which are still being sought, also internationally. A contributing reason to this are the research methods used, which have not provided an understanding perspective on the implementation process of pharmacotherapy and the factors affecting it in people's everyday lives.

Research on treatment adherence should give us a better understanding of the everyday lives of medication users and the way they cope with their medication than we have today. We would need particularly qualitative research deriving from the personal experiential world of medication users, with the help of which we could better understand, for example, the way medicines are used and their impact on the treatment outcomes reached, and medication users' own thinking of how pharmacotherapy should be arranged. Therefore, research should be targeted to understanding the context-reliance of the use of medicines: how the patient uses the medicine within a specific period of time, in a specific place or in a specific setting, when surrounded by diverse information, beliefs and culture. Such understanding can be gained by multidisciplinary research, involving experts from such fields as social and behavioural sciences. It is also important to include patients in the research teams, so that the research questions and settings could be formed in a patient-oriented manner.

Even though a large share of ailments is treated in self-care, there is very little research data on self-care and rational use of self-care medication either in Finland or abroad. Therefore, research should be targeted to promotion of rational self-care and self-medication as part of the health and social services system. It should be estimated by research to what extent the use of other health and social services can be optimised by enhancing rational self-care and self-medication, and how collaboration and division of labour between pharmacies and local health services could be coordinated more efficiently.

Research Topics

- The empowerment, participation and self-management in the pharmacotherapy of both short-term and long-term medical conditions.
- The study and understanding of the empowerment process and its meaning for the effectiveness of pharmacotherapy.
- Patient's expectations for and experiences of drug therapies as part of holistic treatment of medical conditions.
- Partnerships in pharmacotherapy and support given for it, particularly to those who have multiple morbidities and use a lot of medication.
- Observing people who use high-risk medication or are otherwise in need of special support in the implementation of drug treatment.
- Supporting the drug treatment pathway from the patient's point of view: client care plan and medication list, guidance and counselling, follow-up of care, using peer support and its meaning.
- The rapid development of health technologies and integrating them to new drug therapies under development (e.g. pharmacoeconomics).
- The promotion of self-monitoring of the impacts of drug treatment by traditional means and with the help of health technologies (e.g. self-monitoring of blood pressure and blood glucose, INR and CRP measuring, use of My Kanta in self-management).
- Diagnostics of self-managed ailments at home and in pharmacies, differential diagnostics.
- Examining the root causes of good and poor treatment adherence.
- Factors promoting medication adherence and their observation when developing the health and social services structures.
- Implementation, effectiveness, and therapeutic and financial significance of self-medication.
- Citizens’ satisfaction with the availability of self-care medication, information available on self-care medication and attitudes towards the use of self-care medication.
- The connection between the pharmacotherapy and the use of health and social services and the need of hospital care.
- Inappropriate polypharmacy and investigating its root causes.
- Potential harmful medicines in various age groups, high-risk medication and their connection to clinical adverse reactions and use of services.
- Incorrect ways of using medicines.
- Prescription drug abuse.
- Medication use among special groups, such as immigrants.

3.2.5 Monitoring and Assessment of Pharmacotherapy

The purpose of the monitoring of pharmacotherapy is to ensure the impacts and success of treatment, evaluate the whole holistic pharmacotherapy process, and examine the patient's need for information and experiences of drug therapy. By monitoring pharmacotherapy, it is possible to improve treatment outcomes, specify the objectives of medication, identify potential adverse effects and support patient's treatment adherence. The key tools for the monitoring of pharmacotherapy are the client care plan[1] and up-to-date medication list. It also requires functional collaboration with the medication user.

The client care plan (cf. treatment plan) is a plan on the practical implementation of all health and social services the client may need based on his or her personal need of services (Draft Bill for the Freedom of Choice Act in Health and Social Services of 19 October 2017). It also includes up-to-date information on the patient's medication, and the objectives and monitoring of drug therapy. Drawing up a client care plan and using it for supporting the patient's drug therapy and self-management has not yet become a general practice. Research data is needed to promote the use of the plan.

It is one of the biggest obstacles to implementation of rational pharmacotherapy that the health and social care services lack up-to-date information on an individual patient's medication. Even though all prescriptions and information on medication purchases are electronically stored in the Prescriptions Centre of Kanta services, so far, it is impossible to recognise from this data which of the medicines are in use at any given time, or to generate an up-to-date medication list. This calls for not only the development of information systems but also a change in practices, so that physicians would systematically enter information about termination of medication or cancelled prescriptions to the Prescriptions Centre. On the other hand, the update of a medication list must always include a medication review to ensure that the drug treatment is appropriate for the patient. In this context, the concept of medication review includes assessment measures on different levels, of which the one that best serves the monitoring needs of the patient's drug treatment is implemented (medication review, medication assessment, comprehensive medication assessment).

[1] In accordance with the draft bill for the Freedom of Choice Act in Health and Social Services of 19 October 2017 client care plan refers to a plan concerning examinations, treatment or medical rehabilitation in accordance with section 4 of the Act on the Status and Rights of Patients (785/1992), a service and care plan in accordance with section 7 of the Act on the Status and Rights of Social Services Clients (812/2000), a client care plan in accordance with section 39 § of the Social Services Act, a service plan in accordance with section 16 of the Social and Health Services for Older Persons, a service plan in accordance with section 3a(2) of the Act on Services and Assistance for the Disabled (380/1987) and a client plan in accordance with section 30 of the Child Welfare Act (417/2007).

The medication review may be performed by a physician or it may be performed multiprofessionally between pharmacists and nursing professionals. Based on the review, the physician decides on potential changes in the care plan. The objective is to enhance medication safety and the quality of pharmacotherapy. There is not much information available on the cost-effectiveness of medication reviews (Kiiski et al. 2016). Research data is needed particularly on how medication reviews could be targeted to the persons who would benefit from them the most. The implementation and permanence of changes in medication also affect the cost-effectiveness of the reviews. Furthermore, information is needed on the functionality and benefits of multiprofessional collaboration in the monitoring and optimisation of pharmacotherapy.

Research Topics

- Implementation of the monitoring of pharmacotherapy and the holistic pharmacotherapy process: taking the medicine, measuring of the state of health, therapeutic and adverse effects, problems in drug therapy, high-risk medication.
- The use of a client care plan and overall management of medication for people with long-term or multiple medical conditions or polypharmacy or otherwise undergoing demanding drug treatment.
- The appropriateness of pharmacotherapy, the medication information being up to date and the transfer of data from one care unit to another or to home care (including information on the use of over-the-counter (OTC) medicines and nutritional supplements).
- The usability and coverage of the national medicines list included in the Kanta services after its introduction.
- The impacts of the national medicines list on the success rate of pharmacotherapy and the resources assigned to implementation of pharmacotherapy in health and social services and the pharmaceutical service.
- Cost-effective screening and identification of persons with therapeutically significant medication problems or risks in different operating environments. The development of criteria for identifying problems and risks in pharmacotherapy.
- The development, targeting and implementation of multiprofessional assessment practices for pharmacotherapy in different health and social services operating units.
- The development of the process for ensuring that the patients who have problems in their medication or monitoring of their drug therapy can be identified, their problems solved, changes in their medication implemented and their medication monitored and reviewed on a regular basis.
- Monitoring medication errors and learning from them, examining the root causes.

- The implementation and effectiveness of clinical pharmacy services in, for example, informal care, assisted living facilities, supported housing units, and atypical settings for providing drug therapy, such as schools.
- Methodological development of comparative effectiveness research on the monitoring and assessment of pharmacotherapy.

3.2.6 Duration, Discontinuation and Termination of Pharmacotherapy

The intended duration of pharmacotherapy should be decided already when planning drug treatment. The objective and duration of treatment should be entered in the medical records and the client care plan. The necessity of medication should be checked periodically. Research has revealed that the medications intended for short-term use often remain in long-term use. On the other hand, regimens intended as long-term treatment are often discontinued, even though they would still benefit the patient. Sufficient duration of pharmacotherapy should be ensured by means of the monitoring of medication outcomes and use, and by making sure that the patient is aware of the objectives of drug therapy. At the same time, the real and potential adverse reactions caused by drug therapy should also be considered, especially when the treatment continues for an unnecessarily long period of time.

There is only quite limited amount of research data and evidence-based guidelines available on making changes in pharmacotherapy – discontinuing medication in particular – both in Finland and abroad. However, discontinuation of medication has become a subject of active research. Even though the details of the discontinuation processes of many drug therapies remain unexplored, we know that various drug regimens need to be tapered according to a specific plan. To ensure that the discontinuation process succeeds, it is important that it is realised in collaboration between patients and the persons responsible for their care. Information systems also need to be developed, so that they would provide improved support for the monitoring of the duration of pharmacotherapies and discontinuing them, if necessary. Therefore, even when using the existing information systems, one should remember to make entries on the duration of drug therapy and terminating/discontinuing the use of medication, and to cancel prescriptions as needed if there are no longer grounds for continuing the use of medication.

Research is needed on the frequency of inappropriate duration of medication and its causes. Furthermore, it should be studied in what kind of drug therapies and patient groups inappropriate duration of medication is most typically detected. This would help in focusing the attention to the key problem areas. The research data could also

be used for developing the competence that healthcare and social services professionals need when discontinuing pharmacotherapy. Provision of such competence should be included as part of their basic studies, and sufficient continuing training on the subject should also be ensured.

Research Topics

- The frequency of inappropriate duration of medication and its causes.
- In what kind of drug therapies and patient groups inappropriate duration of drug treatment is most typically detected.
- Discontinuing medications and making other revisions in medication (especially antipsychotics, antidepressants, hypnotics and other benzodiazepines, proton-pump inhibitors, bisphosphonates).
- Extended use of medication intended for short-term treatment.
- Renewal of prescriptions and continuation of medication.
- Insufficient duration of long-term medication.
- The competence needed for discontinuing and terminating drug therapies and the development of such competence.
- Collaboration with the patient in the planning, monitoring and discontinuation of medication.

3.2.7 Proactive Risk Management and Safeguards in the Pharmacotherapy Process

Medication safety work is shifting from the retrospective research of medication errors and incidents towards proactive risk management, pharmacovigilance (WHO 2017). Retroactive information is also needed on medication incidents and factors contributing to them, allowing the identification of areas of risk in processes of pharmacotherapy. Based on this data, it is possible to change the provision processes of pharmacotherapy and build safeguards by which the generation of risks can be prevented. The safeguards can include such measures as checking the weight of a child patient and writing it down on the prescription, medication counselling, use of a medication lists, review and safety checks of medication, and risk management and decision-support applications incorporated into information systems. In the future, it should also be possible to use research for screening the most effective and cost-effective safeguards.

Research Topics

- Retrospective and prospective identification of medication risks in various patient groups and operating environments.
- Development, testing and further development of safeguards.
- Safeguards as innovations.
- The effectiveness and cost-effectiveness of safeguards.
- Developing methods for research on proactive management of medication risks.

3.3 Research on the Use of Medicines and on the Effectiveness of Pharmacotherapy

The research on the use of medicines and on the effectiveness of pharmacotherapy can be divided into the following sub-areas: 1) research on the use of medicines, 2) medication safety research, 3) research on the effectiveness and cost-effectiveness of medicinal products and pharmacotherapy, and 4) research on the cost of medicinal products and pharmacotherapy (figure 1).

3.3.1 Use of Medicines

Basic research on the use of medicines has been conducted in Finland for a long time. In addition to register-based studies, the research methods have included extensive population studies and interviews, and qualitative research. The register-based studies in particular have made extensive use of the data from the Prescription Registry of the Social Insurance Institution (Kela).

The research on the use of medicines using both descriptive and evaluating methods produces basic information about prescribing and dispensing of medicines, consumption of medicines, actual use of medicines and direct costs of medicines. With the help of the research on the use of medicines, we can also gather information about medication adherence, continuation of drug treatment, and inappropriate medication or targeting of medication in the population. Research on the overall picture of the use of medicines is needed to analyse the constantly rising pharmaceutical expenditure and inappropriate use of medicines, and for finding solutions to these problems. On the other hand, the development of treatments and processes also benefits from the research on the use of medicines.

The use of medicines changes over time and it has many societal, medical and financial consequences. It is affected by, for example, the development of medicine and

methods of treatment, care guidelines, morbidity among the population, the range of medication on the market, the drug reimbursement system, the individual prescription practices of physicians and pharmaceutical marketing. The use of medicines varies regionally not only between countries but also within countries. Long, statistical time series play a central role in research. The objective is to promote safe and efficient use of medicinal products by identifying factors leading to appropriate and inappropriate use of medication, and by making research efforts to find methods by which the use of medicines can be steered in a more appropriate direction. Making comparisons in the use of medicines between different regions or countries, and predicting changes in use patterns and affecting them helps in the process.

The existing data resources, merging data collected from various registers and combining register data to information gathered using surveys and interviews enable more versatile study of the rational use of medication than is currently possible with the help of population-based materials. In addition to register-based studies, different patient and population studies and qualitative studies provide valuable information on the use of medicinal products and the factors affecting it at the individual and systemic levels. The qualitative research in particular should be increased and methodologically diversified by utilising new methods available for gathering real-world information about people's experiences of the use of medicinal products. For example, social media enables the analysis of the use of medicines from materials covering large research populations.

Research Topics

- The trends in the use of medicines in different public health problems and other conditions and in vulnerable patient groups, such as the elderly, pregnant women, persons with multiple medical conditions, the disabled and people with rare diseases.
- Acquisition of the prescribed medicines from a pharmacy.
- Factors affecting the use of medicinal products.
- Description of the treatment using real-world data, care pathway analysis.
- Inappropriate pharmacotherapy and problems in drug treatment, factors creating incorrect ways of using medication.
- Qualitative research of the use of medicinal products and ways of using medicines (description of the phenomenon and understanding it, research applying the theory and research creating theoretical models).
- The development of research methods for studying the use of medicinal products.

3.3.2 Drug Safety

An area of medication research that has become internationally important is drug safety and pharmacovigilance, the starting points of which are risk management of pharmacotherapy and promotion of patient safety. The WHO has defined pharmacovigilance as a field of science and activities aimed at identifying, assessing, understanding and preventing adverse reactions of medicinal products and other problems caused by medication (WHO 2002).

Pharmacovigilance and related research related to it is conducted by the pharmaceutical industry, the authorities as well as universities, and all of the above in collaboration with each other. Pharmacovigilance and

research are internationally established operations (within EU coordinated by EMA, with the WHO Collaborating Centre for International Drug Monitoring based in Uppsala serving as global coordinator).

Traditionally, drug safety research has utilised risk signals data concerning various medication user groups that physicians and other healthcare professionals have reported to authorities. In recent years, the participation of medication users in spontaneous reporting of adverse drug reactions has become more common. However, research has increasingly expanded to using register-based research methods and other real-world data, allowing the study of impacts of medicinal products on large population groups (Kaeding et al. 2017, Santoro et al. 2017). The research focuses on, for example, conditions caused by medication, currently including such topics as heart risks caused by anti-inflammatory drugs, dementia/cognitive adverse effects caused by medication, the metabolic effects of medication – on the onset of diabetes in particular (e.g. statins and antipsychotics) – and the effects of long-term use of proton-pump inhibitors.

In Finland, not much drug safety research has been conducted in spite of excellent opportunities for such study. The book published by Kaeding and his research team in 2017 gives a fresh analysis of pharmacovigilance in the European Union (Kaeding et al. 2017). The analysis compares practices in six member states (Germany, Portugal, Finland, the United Kingdom, Poland and France).

Research Topics

- Research of the monitoring data on adverse drug reactions in Finland and other countries.
- Development of research methods for adverse drug reactions.
- Conditions caused by medication.

- Adverse drug reactions experienced by medication users.
- The adverse effects of new medicinal products (e.g. biological medicines) and their management.
- The common and rare adverse drug reactions caused by extensively used medication, such as medications for diabetes, high cholesterol, high blood pressure and asthma, analgesics and antipsychotics, and complementing their adverse effects profiles.

3.3.3 Effectiveness of Pharmacotherapy

Research on the effectiveness of pharmacotherapy refers to the examination of the capacity of drug therapy to generate the intended effects under real-world circumstances, in people's normal lives, and as part of the everyday health and social services. The effectiveness can be studied, for example, by means of observational research, pragmatic design of trials, register-based design of trials or other intervention study methods. Unlike in randomised clinical trials, in comparative effectiveness research dropping out of a trial, poor treatment adherence or change of trial groups do not lead to exclusion of the study, and the inclusion criteria applied are quite permissive (Choudhry et al. 2017). Information about effectiveness can also be gathered by means of meta research, with the help of, for example, systematic reviews, meta-analyses or network meta-analyses.

Comparative effectiveness research can be based on register, survey or interview data or patient record information or combinations of any of these. The prerequisite for comparative effectiveness research on pharmacotherapy is that information on clinical outcome variables (such as mortality, incidence rate, clinical health variables) and outcome variables reported by patients (e.g. quality of life and health-related functioning capacity) is systematically collected to healthcare data resources.

Comparative effectiveness research also needs data on factors that influence the impact, such as the targeted use of medicinal products and the care process (e.g. dosage, duration, treatment adherence, former treatments, follow-up treatments). With the help of factors that influence the impact it is possible to define various patient groups who benefit from the treatment in different ways. Factors that influence the impact can include age, gender, other medical conditions, the severity of the illness, the patient's genotype and the medication currently in use or given earlier. The changes in the treatment adherence also influence the impact. When particularly the clinical use of new medicinal products is initiated, the factors that influence the impact are not very well known, and additional research data is needed on them continuously.

Research is needed not only on the effectiveness of pharmacotherapy but also the effectiveness of other interventions related to pharmacotherapy, such as the effectiveness of health applications and meters, monitoring of drug therapy and medication assessments, and the effectiveness of the methods used for promoting treatment adherence.

Research Topics

- The effectiveness and factors that influence the impact of new medicinal products and medicines of significance in terms of cost or number of users (e.g. biological drug therapies for rheumatoid arthritis, diabetes, and haematological, oncological and neurological disorders, medication for rare illnesses).
- The effectiveness of preventive pharmacotherapy, such as drug treatment of high blood pressure, high cholesterol and diabetes.
- Identifying the patients who will benefit the most from treatments with the help of real-world data, biobanks, genetic data and laboratory tests.
- Methods for measuring the effects of medication.
- Prevention and forecasting of infections with the help of big data.
- The development of disease progression models with the help of real-world data.
- The experiences of medication users of the benefits and adverse effects of medication.
- The health and financial impacts caused by unfounded drug therapies, ineffective pharmacotherapy processes and medication errors.

3.3.4 Costs and Economic Assessment of Medicinal Products and Pharmacotherapy

1) New and expensive medicinal products

The increasing pharmaceutical expenditure may derive from the increase in the amount of use, price increases or renewing range of medicinal products. International factors, such as the European community regulations, trade agreements and the availability of medicines, also greatly affect the use and prices of medicines, and research and development of the pharmaceutical industry.

It is sensible to focus the research on the cost of medicines to medicines which generate the largest costs due to large amount of use or expensive medicines. New medications are invariably expensive and, particularly at the initial stages of clinical use, they are authorized to a relatively small group of patients. Information on the actual effectiveness and safety of medicinal products is gradually complemented after the medicinal product has entered the market.

On the other hand, the sensible use of generic drugs and biosimilars enables the introduction of new innovative drugs. As part of the implementation programme for rational pharmacotherapy, we strive to increase the introduction of biosimilars and to promote price competition.

In the coming years, new drug therapies will be even more precisely tailored for each patient for improved effectiveness and safety. The decisions on the introduction of new medicinal products are usually far-reaching both therapeutically and financially. Open questions include such as the impacts of different financing and payment methods on the availability and arrangement of treatment and the prioritisation of different treatments or patient groups. Systematic register-based monitoring and research on the use of new and expensive medicinal products is needed, monitoring not only the clinical outcome variables but also the treatment outcomes in a wider scale, such as in terms of working and functional capacity, or quality of life.

Research Topics

- Introduction of new medicines, generic drugs and biosimilars, market shares, and other factors affecting the selection of treatments and patients.
- Monitoring and management of the budget impact of the use of new medicinal products and how to affect them.
- The causes of cost increases in various medicinal product groups.
- Drug and medication costs and the impact of pharmacotherapy on the use of other resources.

2) Economic Evaluation

Pharmacoeconomics applies the methods of health economics to studying the phenomena related to pharmacotherapy. In economic evaluation, the costs and health effects of the drug therapy under assessment are compared to one or several alternative treatments with the same therapeutic indication. The objective is to identify the treatments that produce as high health benefits as possible with the resources available. This information is needed continuously as background information for treatment-related decisions. In most cases, the economic assessment is based on cost-effectiveness or cost-utility analysis.

An economic assessment is typically performed by means of modelling. Modelling is used for various reasons, for example, because usually not all data needed for an economic assessment has been collected in a single study or because the applicability of clinical trials on the Finnish population is limited. The structure of the model and the values fed into the model must describe the Finnish target population and healthcare system as well as possible. The values refer to, for example, progression

of the illness or changes in the state of health, life expectancy, health-related quality of life, treatment processes or parameters describing the use of resources. The production and publication of such information, using data accumulating into, for example, healthcare registers, biobanks, patient information systems or other health and social services data resources would support making of modelling-based economic assessments in Finland.

If all information on health benefits, adverse effects, use of healthcare resources and healthcare costs relevant with a view to economic assessment were collected into health and social services data resources, in certain cases it might be justified to base the economic assessment on this data instead of combining data from various sources by means of modelling.

Research Topics

- Production of cost-effectiveness data to support decision-making on prescriptions.
- The cost-effectiveness of new medicinal products and medicines of significance in terms of cost or number of users.
- Research supporting economic assessment, and building and parametrisation of models. Producing data from, for example, the following: prognosis of a condition, description of the target group for treatment (the factors that influence the impact in particular), use of alternative treatments (dosage, duration, treatment adherence), treatment outcomes, use of resources.
- Measuring and detailed characterisation of the health-related quality of life.
- Further development of research methods.

3) The Role of Drug Reimbursement System in Steering Rational Use of Medicines

Attention should be paid to the functionality of the drug reimbursement system and the capacity of the patients to acquire the medication they need. The drug reimbursement system used in Finland is based on the severity of the condition: the share of reimbursement rises in proportion to how severe and how long-term illness the patient has. Reimbursment eligibility is justified with a specified medical certificate particularly in case of illnesses which require expensive medication or cause major expenses. This way, medication expenditure is steered towards severe and long-term illnesses. In a drug reimbursement system based on the amount of costs only, the prescribing practices can be steered by other means. Changes in the Finnish drug reimbursement

system may have different repercussions that change the use of medication, on which more research data would be needed.

In Finland, the financial status of the medication user does not affect the drug reimbursement paid to him or her. However, the reimbursability of a medicinal product is an important requirement for the access to medication. People with low incomes get support for their necessary medication acquisitions also from social assistance. In the Finnish system, people with low incomes may need to make compromises on their medication purchases. This is an essential issue with a view to equal access to pharmacotherapy, and more information is needed on the impacts of income and financial difficulties on the use of medication.

Research Topics

- The impacts of changes in the drug reimbursement system, competition within the pharmaceutical sector and various medicines policy measures on medication expenses.
- The impacts of changes in the drug reimbursement system on the use of medication.
- Assessment of the coverage and fairness of the drug reimbursement system on the background of medicines policy measures.
- Equality in the availability of and access to medication (e.g. the patient's possibilities to acquire the medication he or she needs).
- The differences in the medicines policies, medication expenses and drug reimbursement systems in different countries.
- The possibilities of the drug reimbursement system to steer the appropriateness of pharmacotherapy.
- The impacts of multisource financing system of medicines on prescribing practices.
- The extent of support for pharmacotherapy via social assistance.
- The impacts of the generic substitution system and the reference price system on medication expenditure and use of medication.

4 Improving the Preconditions of Research

4.1 Enhancing Cooperation between Research Groups with the Help of Research Networks

Functional national and international cooperation and networking is the precondition of successful and high-quality research operations in the field of rational pharmacotherapy as well. Through cooperation research groups strive to enhance their competences and versatility, boost the use of resources targeted for research, and improve the mobility and application of research data. In an ideal situation, rational pharmacotherapy is based on national and international scientific research produced for the needs of health and social services by an active network of researchers. The cooperation of researchers with the healthcare and social services organisations and professionals and medication users is an essential part of the research process.

There are researchers in various research networks within the health and social services sector who conduct research related to rational pharmacotherapy. However, there has been no research networks focused specifically on rational pharmacotherapy in Finland. Such a network is now being assembled as part of the implementation programme for rational pharmacotherapy (Ministry of Social Affairs and Health 2017). The purpose of the research network is 1) to increase collaboration between researchers by various means, 2) strengthen the methodological competence, 3) increase multidisciplinary research and 4) expand the understanding of pharmacotherapy as part of the holistic care process and everyday lives of the patients. When planning and implementing research, account is taken of patient orientation and medication user orientation. Networks are used for the planning and implementation of research, and practical application of research results. The researchers seek to specifically develop collaboration with healthcare and social services professionals and patients in the planning and implementation of research.

The researchers also aim to strengthen international research cooperation. Here as well, they can take advantage of the existing versatile cooperation and networks or create new connections. New technologies are used for promoting networking, which enables virtual communications and operations (e.g. research meetings and seminars, and researcher training) Researcher and expert visits are also encouraged. The

goal is to establish new concrete research projects and increase researcher training and potentially research funding applications.

4.2 Research and Development Aimed at Developing the Operations of New Health and Social Services Regions

The strategic goal of research is to bring the academic and practical clinical research closer to each other than they are today. Research topics arising from practical needs serve well the promotion of rational pharmacotherapy. Research cooperation and joint research projects create new practices and new competences both for the academic and clinical stakeholders. Cooperation promotes the application of the competence in academic methodology and internationally established good practices to supporting the local development work. In addition, cooperation enables sharing the results of local research and development work with other practitioners and, in the form of publications, on national and international publication forums.

State Research Funding (VTR, formerly Special State Subsidy, EVO funding) has enabled the development of operations and competences with the help of research and training. In the future, it should be ensured that research, development, and training continue to be included as a part of the new health and social services system. This calls for allocation of resources. Training and research not only develop the local approaches but also enhance expertise and competence. A lot of R&D is produced through specialisation training (e.g. physicians, psychologists, qualified chemists, pharmacists, social workers), which should be taken into account in the development funding for health and social services. Health and social services regions also need infrastructure that supports research and assessment work.

4.3 Ensuring Research Funding

One threat to implementation of research related to rational pharmacotherapy is the scarcity of resources and research funding. For the most part, research funding has been granted on quite short-term basis and to individual researchers.

The rational pharmacotherapy research described in this research strategy may have significant and extensive national impacts on the promotion of medication safety and the development of cost-effective drug therapies and medication practices. In spite of its significance, no extensive funding schemes have been set up for research within

the field. Therefore, in the future we should set it as our goal to have a funding scheme set up for research promoting rational pharmacotherapy through, for example, the Government's strategic research funding and/or the Academy of Finland.

Medication is a major expense item in the Finnish health and social services system (National Institute for Health and Welfare 2017). The annual direct medication costs amount to approximately 3 billion euros and they account for about 12% of the overall healthcare expenditure (Finnish Medicines Agency Fimea and Social Insurance Institution of Finland 2016). This share does not include the resources needed for provision of pharmacotherapy. The functionality of the provision of pharmacotherapy is of decisive importance with a view to the actual overall benefits gained through drug treatments in proportion to the overall costs caused by the provision of pharmacotherapy.

4.4 Utilisation of New Data Resources

The Finnish healthcare system has substantial data resources, which could be used more for research purposes than is done today. These data resources enable gathering of information about the effectiveness of care. The Government Bill to Parliament as a Law on Secure Exploitation of Health and Social Services Data (Government Bill 159/2017) proposes establishment of a national licensing authority to coordinate granting of research permits for the use of personal customer data and other personal information related to health and welfare. In the long run, this might make granting of access rights and availability of register data significantly easier.

The objective of the implementation programme for rational pharmacotherapy is that the data accumulating in health and social services data resources would be nationally comprehensive, of high quality, in a usable format and readily available for supporting knowledge management (Ministry of Social Affairs and Health 2018a). Health and social services data resources refer to the real-world data accumulating in such places as healthcare registers, patient information systems and Kanta services, biobanks and genome databases (Ministry of Social Affairs and Health 2018a).

The data routinely accumulating in health and social services data resources is the prerequisite for the implementation of comparative effectiveness research on pharmacotherapy. The data can be used for many other purposes as well, including monitoring the implementation of decisions and recommendations related to the use of medication; enhancing research opportunities; fulfilment of the obligation to produce data potentially related to conditional reimbursement decisions; monitoring of the impacts and costs of drug therapies; production of regional reference data; study of the use

and way of using the treatments available; fulfilment of the obligation to produce data related to adaptable licencing and conditional marketing authorisation procedures; and complementing the research data of pharmaceutical companies.

The lack of comprehensive registers on medication purchases and prescriptions has been a significant shortcoming from the viewpoint of the assessment of pharmacotherapy in outpatient care. The prescription database maintained by Kela only records data on outpatient medication purchases reimbursed by Kela; in 2015 the database included 44 million prescriptions on 56 million prescriptions delivered. The entry of all electronic prescriptions into the Prescription Centre and Prescription Archive as from 1 January 2017 opens new opportunities for prescription register-based research. The information centrally available on medication used in inpatient care only includes sales data with wholesale prices. Research on the use and costs of medications used in hospitals and other care facilities would require centralised data on the actual medication expenditure and patient-specific data on the use of medication during inpatient care.

In outpatient care, medication safety information is not collected in a comprehensive manner. Hospitals, on the other hand, collect medication safety information in their electronic systems in increasing amounts. The future health and social services regions should collect quality and effectiveness data from the perspective of medication safety to be used as a basis for further development. The measures that enhance the use of data when making care decisions is an important area of development.

A monitoring system of prescription practices is a precondition for the evaluation of the rationality of pharmacotherapy. The sales statistics of medication and Kela statistics enable observation of the consumption and use of medication at a general level. In addition, research data is needed on how pharmacotherapy was implemented, which potential problems related to prescription practices occurred, how extensive these problems were, and which factors contributed to them. Problems can be identified and verified using information on medication purchases and other register-based data at a personal level. However, to ensure the rationality of pharmacotherapy, more exact information than is currently available would be needed on the indication for use and the duration of use of the drug. The register data is not yet comprehensive in this respect.

4.5 Utilisation of Indicator Data for Research Purposes

Indicators are used for describing the current state of affairs, monitoring a change in time and comparing different areas with each other. Indicator data can be used for the purposes of knowledge management, decision-making and steering. Indicator data does not replace research data, but it provides information on which phenomena should be targeted next in scientific research. Research is needed for examining cause and effect relationships and as a foundation for development measures.

Indicators for monitoring rational pharmacotherapy have been considered as part of the implementation programme for rational pharmacotherapy. Indicators would allow, for example, monitoring of and reporting on medication expenditure, the development of the use and consumption of medication, and the quality and effectiveness of pharmacotherapy in the national scale, in different areas, such as counties, at a local level and by organisation. Different indicators are needed for follow-up and steering of operations at different levels (figure 2).

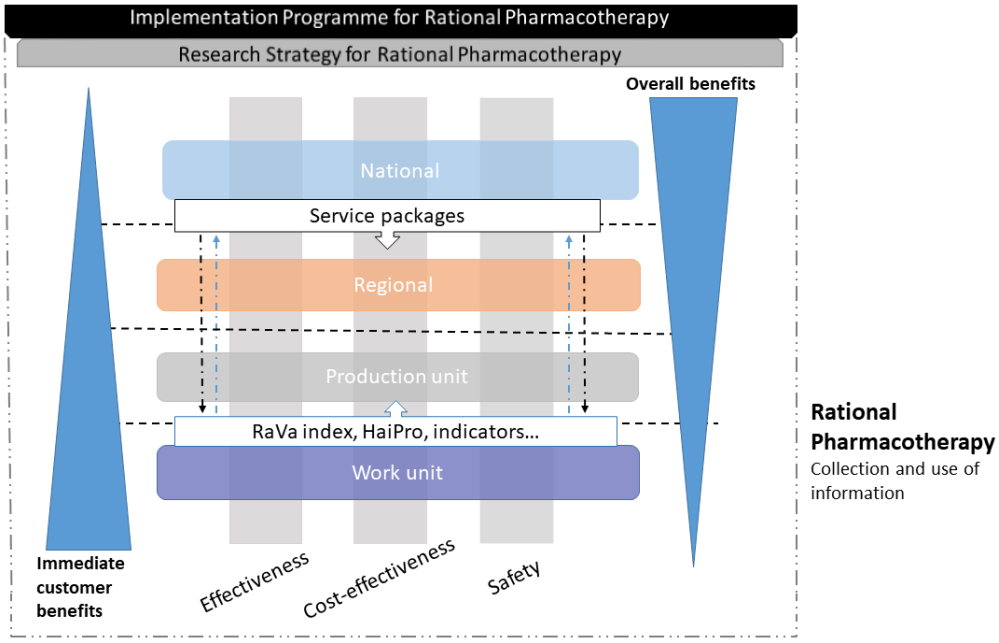

Figure 2. The various levels of the need of information on rational pharmacotherapy (Hakoinen et al. 2017)

The Ministry of Social Affairs and Health and Sitra have started to draw up national 'information packs on health and social services' to be used as a tool for steering the organisation of healthcare and social services. Different health and social services

have been integrated into entities that make sense from the client's point of view. A separate information pack has also been compiled on the pharmaceutical service. The objective is that the information packs would also make it easier to compare the quality and cost of services between different areas than before. The information pack on pharmaceutical service was piloted in 2017.

5 Summary

The need for research on rational pharmacotherapy is great. Research data is needed both in support of medicines policy decision-making and for the development of the quality and practical modes of operation of drug treatment in, for example, healthcare and social services organisations, pharmacies and hospital pharmacies. The research data also enables development of the training and competence of healthcare and social services professionals. The research within the topic area is practical and it can support, for example, methodological development or, say, implementation of public campaigns.

The field of rational pharmacotherapy research is wide. This research strategy describes the needs of research supporting rational pharmacotherapy from various different perspectives. The objective was to describe research themes and topics and to present them in concrete terms, not to prioritise them in any way. Research related to rational pharmacotherapy is conducted all over Finland in many fields of science and in different research groups. It is hoped that the research strategy would serve as a tool for focusing research and increasing cooperation, and for making new research initiatives within this area of research.

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APPENDIX 1. Composition of the Working Group on Research for the Implementation Programme for Rational Pharmacotherapy

Chair: PhD (Pharm.) Marja Airaksinen, Professor, University of Helsinki

Secretary: PhD (Pharm.) Leena Saastamoinen, Senior Researcher, Adjunct Professor, Social Insurance Institution (Kela)

Members:

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PhD Marja Härkänen, Post-doctoral researcher, University of Eastern Finland

MD, eMBA Pirjo Laitinen-Parkkonen, Adjunct Professor, Director of Health Care and Social Services, Head of Medical Services, Joint Municipalities of Middle Uusimaa

MD Outi Lapatto-Reiniluoto, Specialist in clinical pharmacology and internal medicine, Department of Clinical Pharmacology, Helsinki University Hospital

PhD (Pharm.) Saija Leikola, Development Manager, Pharmac Finland Oy

PhD (Pharm.) Inka Puumalainen, Manager, Healthacare customers business unit, University Pharmacy

MD Juha Puustinen, Head of Section, Consultant neurologist, Special competence in medical education, Satakunta Hospital District

Experts:

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PhD (Pharm.) Marika Pohjanoksa-Mäntylä, Senior lecturer, University of Helsinki

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